National Park Service
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Natural Resource Stewardship and Science

Bird Community Monitoring at Lincoln Boyhood National Memorial, Indiana

Status Report

Natural Resource Data Series NPS/HTLN/NRDS—2011/210

ON THE COVER
Sign at entrance to Lincoln Boyhood National Memorial.
Photo from Heartland Network Files

Bird Community Monitoring at Lincoln Boyhood National Memorial, Indiana

Status Report

Natural Resource Data Series NPS/HTLN/NRDS—2011/210

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The Natural Resource Data Series is intended for the timely release of basic data sets and data summaries. Care has been taken to assure accuracy of raw data values, but a thorough analysis and interpretation of the data has not been completed. Consequently, the initial analyses of data in this report are provisional and subject to change.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner. Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

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Introduction

Birds are an important component of park ecosystems, as their high body temperature, rapid metabolism, and high ecological position in most food webs make them good indicators of the effects of local and regional changes in ecosystems. It has been suggested that management activities aimed at preserving habitat for bird populations, such as for neotropical migrants, can have the added benefit of preserving entire ecosystems and their attendant ecosystem services (Karr 1991, Maurer 1993). Moreover, birds have a tremendous following among the public and many parks provide information on the status and trends of birds through their interpretive programs.

We use trends in the composition and abundance of bird populations as long-term indicators of ecosystem integrity in the varied habitats of Lincoln Boyhood National Memorial, Indiana (LIBO). Ecosystem integrity is defined as the system's capability to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of the natural habitat of the region (Karr and Dudley 1981). Research has demonstrated that birds serve as good indicators of changes in ecosystems (Cairns et al. 2004, Mallory et al. 2006, Wood et al. 2006).

Therefore, changes in the population size and community composition of birds on the park may reflect the effectiveness of management in restoring and maintaining the various vegetative communities at LIBO. Long-term trends in community composition and abundance of breeding bird populations provide one measure for assessing the ecological integrity and sustainability of these systems.

Methods

Site Selection for Bird Plots

Permanent monitoring locations or 'plots' were selected by overlaying a systematic grid of 100 x 100 meter cells (originating from a random start point). The orientation of the grid was rotated 45 degrees to prevent monitoring sites from being influenced by man-made features (roads, fences, etc.) located along cardinal directions. Forty-one permanent plots comprised the original grid, six of which fall in culturally sensitive areas, therefore are not sampled (Figure 1). The 35 plots sampled were surveyed for birds by Heartland I&M Network (HTLN) staff on June 9 and 10, 2007 and on May 20 and 21, 2011. Habitat was assessed on the 35 plots as well.

During bird surveys, monitoring plots were located using navigation waypoints (Appendix 1) in a GPS unit and temporarily marked with 36-inch pin flags to aid in re-locating the plots for habitat assessment, eliminating the need for permanent plot markers. We collected pin flags from each plot once the habitat work was completed

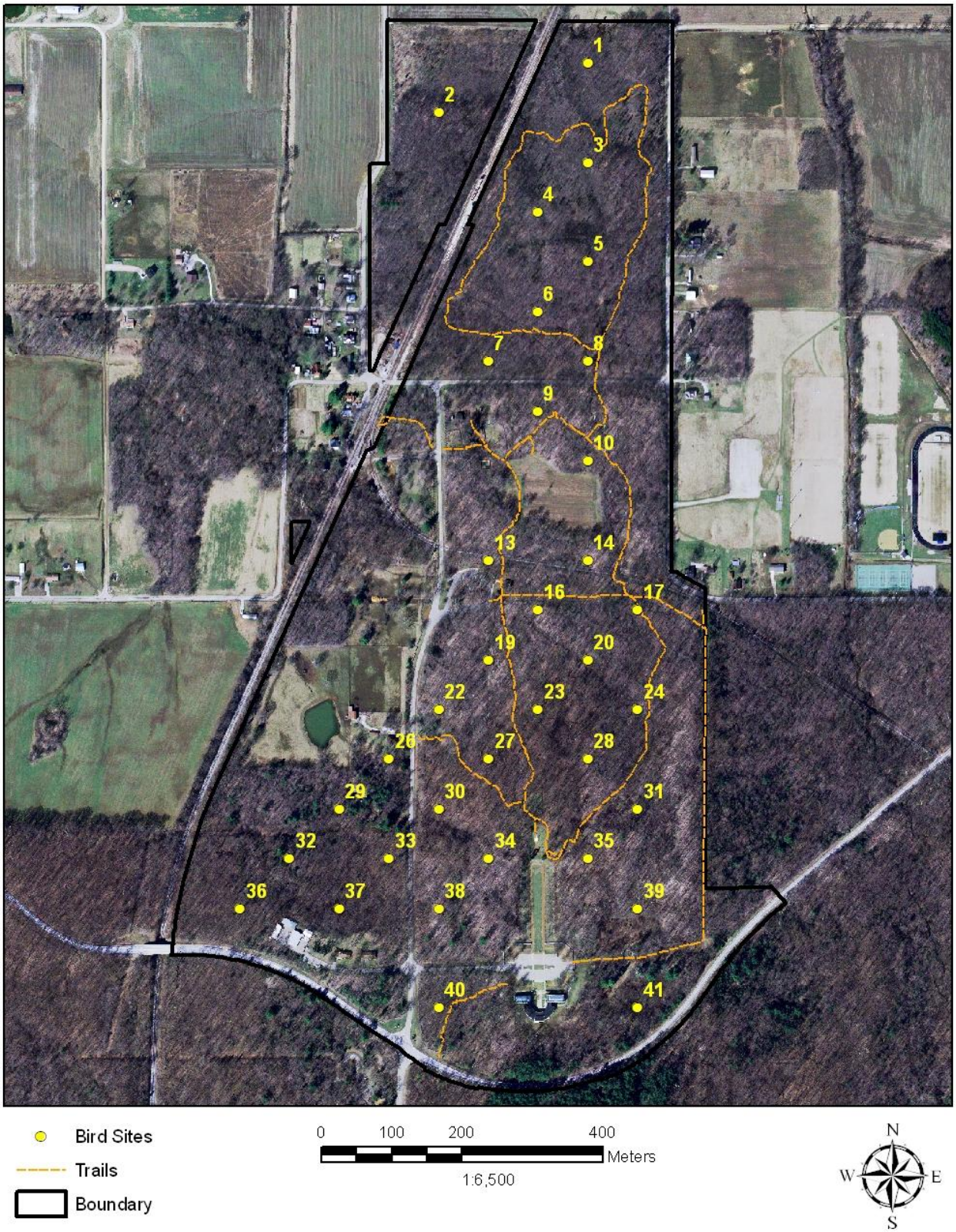

Figure 1. Bird plot locations on Lincoln Boyhood National Memorial, Indiana.

Bird Surveys

Bird surveys followed methods outlined in the bird monitoring protocol by Peitz et al. (2008) and summarized below. Variable circular plot counts, a point count methodology that incorporates a measure of detectability into population estimates, were used to survey birds present (Fancy 1997). All birds seen or heard at plots during 5-min sampling periods were counted along with their corresponding distance from observer. Bird observations were separated into two time segments: those detected during the first three minutes of the count (to allow future comparisons with the national Breeding Bird Survey data), and any new birds detected during the final two minutes of the count. For most species, we recorded each individual bird as a separate observation. For species that usually occur in clusters or flocks, the units recorded were cluster or flock size, and not the individual bird. During analysis, each individual in a cluster or flock were treated as a separate observations. After completing a count at a plot, and filling out the data sheet, the observer(s) navigated to the next plot using a GPS unit. While traveling between plots, the observer(s) was vigilant for the presence of species not recorded during timed surveys. These species help formulate a more complete species list for the park by identifying species missed during timed surveys. We sampled birds during a period when it was light enough to observe birds to four hours after sunrise.

Bird Habitat

The collection of habitat data in 2007 and 2011 followed methods outlined in the bird monitoring protocol by Peitz et al. (2008). A summary of the sampling methods follows. Habitat data collection started after the first variable circular plot count was completed. Observers visited plots for habitat measures in the same order they were surveyed for birds to avoid disturbing birds on a plot prior to the survey. Once the habitat crew arrived at a plot, they set up the center subplot and completed all habitat measures for this subplot and the 50-m radius plot.

We characterized habitat available for each bird species on a number of different scales. Slope, slope variability, aspect, aspect variability, and topographic position of each 50-m radius plot were determined and recorded first. Measurements were recorded during this first year of monitoring, and will not be re-measured in subsequent years. The amount of various vegetation types (disturbed floodplain, lawn, railroad tracks, trail, or woodland) and the amount of road and water cover on each plot sampled were recorded. As plots were sampled, horizontal vegetation cover was estimated in 0.50-m (2007) or 0.25-m (2011) intervals from 0.0 to 2.0 meters above ground surface using a 0.15-cm wide cover board. Area of the cover board obscured by vegetation was estimated at a 15-m distances from plot center. Area of the cover board obscured by vegetation was estimated at a 15-m distances from plot center. Using a graduated measuring rod, vertical vegetation structure was measured in 1-m increments up to 7.5 meters in height at four locations around the perimeter of the subplot. Locations were in the four cardinal directions. Vertical structure was recorded for deciduous and herbaceous vegetation. Trees were tallied by species and size class (<1.0 cm, 1.1 – 2.5 cm, 2.6 – 8.0 cm, 8.1 – 15.0 cm, 15.1 – 23.0 cm, 23.1 – 38.0 or >38.0 cm) on the subplot. Lastly, at the subplot, ground and foliar cover were recorded in a 1.78-m radius nested sample plot. Ground cover included deciduous and grass litter, bare soil, rock, woody debris (>2.5 cm diameter), and unvegetated. Foliar cover was estimated for six plant guilds, including warm- and cool-season grasses, forbs, moss and lichens, shrubs and vines, tree seedlings, and total foliar cover (<1.5 m tall). Average parameter values were reported for the Monument.

Data Analysis

Prior to summary analysis, the residency status (permanent resident, summer resident, migrant, species out of their normal range, and winter resident) of each bird species recorded was determined. Identifying the residency of each species helps to exclude migrants, species out of their normal range, and winter residents from analysis of breeding birds within LIBO. Hereafter, permanent and summer resident birds are referred to as breeding species. The frequency and abundance of breeding bird species were determined two ways. First, for each breeding species, the number of individuals encountered per plot visit was determined (individuals / plot visit). And second, the proportion of plots occupied by each breeding species was determined (total number of plots occupied by a species / total number of plots visited).

Location and permanent abiotic measures on each plot and habitat subplot were determined. Averages ($\pm$ std dev) for semi-permanent plot data, including road and water cover were calculated from plot estimates. Using plot values, averages ($\pm$ std dev) for horizontal vegetation cover between 0 – 0.25, 0.25-0.5, 0.5 – 0.75, 0.75-1.0, 1.0 – 1.25, 1.25-1.5, 1.5 – 1.75, and 1.75 – 2.0 meters were calculated. Average ($\pm$ std dev) vertical structure diversity was estimated and reported as well.

$$\text{Structural Diversity Index} = \frac{((\sum p_i / 8) + a) * 100}{2}$$

Where p_i – is the observed frequency for vegetation in the $_i$th interval touching a measuring rod out of eight measuring events, and a – is the percent of intervals with recorded vegetation in eight height increments. Vertical structure diversity values are weighted equally to represent both the vertical height of vegetation and how dense the vegetation is within each height increment.

Within each habitat, ground cover, including deciduous and grass litter, bare soil, rock, woody debris (>2.5 cm DBH), and unvegetated were averaged ($\pm$ std dev) across plots. Foliar cover, by guild of warm- and cool-season grasses, forbs, mosses and lichens, shrubs and vines, tree seedlings and total foliar cover (<1.5 m tall) were averaged ($\pm$ std dev) across plots as well. Also reported were species composition and size classes of trees.

Results

Bird Surveys

Forty-two avian species were recorded on LIBO during breeding bird surveys in 2007 and 2011 (Table 1). Twenty-one of the 42 species are year round residents, with the remaining species summer residents (Stokes and Stokes 1996). Four species, Eastern Bluebird (*Sailia sialis*), Hairy Woodpecker (*Picoides villosus*), White-eyed Vireo (*Vireo griseus*), and Wild Turkey (*Meleagris gallopavo*) were only recorded outside of 5-min survey periods.

On LIBO, Acadian Flycatcher (*Empidonax virescens*), Carolina Wren (*Thryothorus ludovicianus*), Eastern Towhee (*Pipilo erythrophthalmus*), Indigo Bunting (*Passerina cyanea*), Kentucky Warbler (*Oporornis formosus*), Prothonotary Warbler (*Protonotaria citrea*), Red-bellied Woodpecker (*Melanerpes carolinus*), Red-headed Woodpecker (*Melanerpes erythrocephalus*), White-eyed Vireo (*Vireo griseus*), Wood Thrush (*Hylocichla mustelina*), Yellow-throated Vireo (*Vireo flavifrons*), and Yellow-throated Warbler (*Dendroica dominica*) are breeding species of continental importance (Rich et al. 2004). Indigo Bunting, American

Crow (*Corvus brachyrhynchos*), Northern Cardinal (*Cardinalis cardinalis*), and Tufted Titmouse (*Parus bicolor*) are the most commonly encountered and widely distributed species on the Memorial, annually (Table 2).

Table 1. Bird species recorded during breeding bird surveys at Lincoln Boyhood National Memorial, Indiana in 2007 and 2011. The American Ornithologists' Union Code (AOU code) and residency status of each species is given. Bolded species names are those species considered of continental importance (Rich et al. 2004).

Common name	Species name	AOU code	Residency[1]
Acadian Flycatcher	***Empidonax virescens***	**ACFL**	**SR**
American Crow	*Corvus brachyrhynchos*	AMCR	R
American Robin	*Turdus migratorius*	AMRO	R
American Woodcock	*Scolopax minor*	AMWO	R
Baltimore Oriole	*Icterus galbula*	BAOR	SR
Blue-gray Gnatcatcher	*Polioptila caerulea*	BGGN	SR
Blue Jay	*Cyanocitta cristata*	BLJA	R
Carolina Chickadee	*Parus carolinensis*	CACH	R
Carolina Wren	***Thryothorus ludovicianus***	**CARW**	**R**
Chimney Swift	*Chaetura pelagica*	CHSW	SR
Common Grackle	*Quiscalus quiscula*	COGR	R
Eastern Bluebird*	*Sailia sialis*	EABL	R
Eastern Towhee	***Pipilo erythrophthalmus***	**EATO**	**R**
Eastern Phoebe	*Sayornis phoebe*	EAPH	SR
Eastern Wood-pewee	*Contopus virens*	EAWP	SR
(Eastern) Tufted Titmouse	*Parus bicolor*	ETTI	R
Great Crested Flycatcher	*Myiarchus crinitus*	GCFL	SR
Gray Catbird	*Dumetella carolinensis*	GRCA	SR
Hairy Woodpecker*	*Picoides villosus*	HAWO	R
Indigo Bunting	***Passerina cyanea***	**INBU**	**SR**
Kentucky Warbler	***Oporornis formosus***	**KEWA**	**SR**
Northern Bobwhite	*Colinus virginianus*	NOBO	R
Northern Cardinal	*Cardinalis cardinalis*	NOCA	R
Northern Mockingbird	*Mimus polyglottos*	NOMO	R
Northern Parula	*Parula Americana*	NOPA	SR
Ovenbird	*Seiurus aurocapillus*	OVEN	SR
Pileated Woodpecker	*Dryocopus pileatus*	PIWO	R
Prothonotary Warbler	***Protonotaria citrea***	**PROW**	**SR**
Red-bellied Woodpecker	***Melanerpes carolinus***	**RBWO**	**R**
Red-eyed Vireo	*Vireo olivaceus*	REVI	SR
Red-headed Woodpecker	***Melanerpes erythrocephalus***	**RHWO**	**R**
Red-tailed Hawk	*Buteo jamaicensis*	RTHA	R
Sharp-shinned Hawk	*Accipiter striatus*	SSHA	R
Summer Tanager	*Piranga rubra*	SUTA	SR
White-breasted Nuthatch	*Sitta carolinensis*	WBNU	R
White-eyed Vireo*	***Vireo griseus***	**WEVI**	**SR**
Wild Turkey*	*Meleagris gallopavo*	WITU	R
Wood Thrush	***Hylocichla mustelina***	**WOTH**	**SR**
Yellow-billed Cuckoo	*Coccyzus americanus*	YBCU	SR
Yellow-throated Vireo	***Vireo flavifrons***	**YTVI**	**SR**
Yellow-throated Warbler	***Dendroica dominica***	**YTWA**	**SR**
Yellow Warbler	*Dendroica petechia*	YWAR	SR

* Species recorded only while traveling between point transects or at other times outside of 5-min survey periods.

[1] Residency: SR = summer resident; R = year around resident; According to Stokes and Stokes (1996). Species names are valid and verified names taken from ITIS (Integrated Taxonomic Information System). http://www.itis.usda.gov/.

Table 2. Number of individuals encountered per plot visit, and proportion of plots out of 35 occupied by breeding bird species at Lincoln Boyhood National Memorial, Indiana in 2007 and 2011. Number of individuals per plot, and proportion of plots occupied includes all individuals recorded on plots during a 5-minute survey, including flyovers.

	Individual / plot visit		Proportion of plots occupied	
Common name	2007	2011	2007	2011
Acadian flycatcher	**0.06**	**0.09**	0.06	**0.09**
American crow	0.31	0.80	0.23	0.20
American robin	0.06	0.03	0.06	0.03
American woodcock	0.03	--	0.03	--
Baltimore Oriole	--	0.03	--	0.03
Blue-gray gnatcatcher	0.23	0.31	0.23	0.29
Blue jay	0.09	0.03	0.09	0.03
Carolina chickadee	0.09	0.09	0.09	0.09
Carolina wren	**0.23**	**0.23**	0.23	**0.20**
Chimney swift	0.06	--	0.03	--
Common grackle	0.03	--	0.03	--
Eastern towhee	**0.03**	**--**	0.03	**--**
Eastern Phoebe	--	0.03	--	0.03
Eastern wood-pewee	0.26	0.20	0.20	0.17
(Eastern) Tufted titmouse	0.40	0.34	0.31	0.34
Great crested flycatcher	0.11	0.31	0.11	0.29
Gray catbird	0.06	--	0.06	--
Indigo bunting	**0.29**	**0.89**	0.26	**0.71**
Kentucky warbler	**0.03**	**--**	0.03	**--**
Northern bobwhite	0.03	--	0.03	--
Northern cardinal	0.69	0.29	0.54	0.26
Northern Mockingbird	--	0.03	--	0.03
Northern parula	0.09	0.11	0.09	0.11
Ovenbird	0.03	0.06	0.03	0.06
Pileated woodpecker	0.09	0.09	0.06	0.09
Prothonotary warbler	**0.03**	**--**	0.03	**--**
Red-bellied woodpecker	**0.20**	**0.06**	0.20	**0.06**
Red-eyed vireo	0.11	--	0.09	--
Red-headed woodpecker	0.06	**--**	0.06	**--**
Red-tailed Hawk	--	0.03	--	0.03
Sharp-shinned hawk	0.03	0.03	0.03	0.03
Summer tanager	0.03	0.17	0.03	0.17
White-breasted nuthatch	0.17	0.06	0.17	0.06
Wood thrush	**0.11**	**--**	0.11	**--**
Yellow-billed cuckoo	0.26	--	0.23	--
Yellow-throated vireo	**0.11**	**0.23**	0.11	**0.23**
Yellow-throated warbler	**0.03**	**0.03**	0.03	**0.03**
Yellow warbler	0.03	0.11	0.03	0.11

Bolded species names are those species considered of continental importance (Rich et al. 2004).

Bird Habitat

Abiotic features of plots sampled for breeding birds and habitat composition are given in Table 3. Slope and aspect variability were low for the majority of plots sampled. Plots were located on level topographic positions, with slope across plots variable, but never exceeding 14^{o}.

Plots surveyed for birds average over 79% woodland habitat type with far smaller amounts of several other habitat types present (Table 4). Canopy cover averaged over 93% on plots in 2007

and 85% on plots in 2011, with most being from hardwood trees. Basal area from hardwood trees averaged almost 19 m^2/ha in 2007 and 27% in 2011. Hardwood tree species from fifteen different families contributed to the canopy cover and basal area (Figure 2). Tree species from the family *Cupressaceae* account for the limited amount of conifer canopy cover and basal area recorded.

Horizontal vegetation cover averaged 44% or more below 1.0 m, with lesser amounts observed above 1.0 m in both years. Vertical structure diversity estimates averaged 24% on plots sampled in 2007 and 36% on plots in 2011. Deciduous litter was the most prominent litter type, with small amounts of conifer and grass litter present in both years. Ground cover was mostly unvegetated, woody debris and bare soil in both 2007 and 2011. Forbs and woody shrubs and vines provided the greatest amount of live foliar cover. Total foliar coverage averaged 29% across plots in 2007 and 40% in 2011.

Table 3. Abiotic features of 50-m radius plots sampled for breeding birds at Lincoln Boyhood National Memorial, Indiana.

Plot number	Slope (^{O})	Slope variability	Aspect (^{O})	Aspect variability	Topographic position	Habitat type
LIBOTweety1	4.0	Low	232	Low	Level	Woodland / Edge
LIBOTweety2	5.0	Low	273	Low	Level	Woodland
LIBOTweety3	1.0	Low	52	Low	Level	Woodland
LIBOTweety4	4.0	Low	220	Low	Level	Woodland
LIBOTweety5	2.0	Low	13	Low	Level	Woodland
LIBOTweety6	5.0	Low	290	Low	Level	Woodland
LIBOTweety7	7.0	Low	310	Low	Level	Woodland / Edge
LIBOTweety8	4.0	Low	278	Low	Level	Woodland / Edge
LIBOTweety9	10.0	Low	28	Low	Level	Woodland
LIBOTweety10	10.0	Low	51	Low	Level	Woodland
LIBOTweety13	6.0	Medium	280	Medium	Level	Woodland / Edge
LIBOTweety14	5.0	Low	252	Low	Level	Woodland / Edge
LIBOTweety16	8.0	Low	128	Low	Level	Woodland
LIBOTweety17	2.0	Low	282	Low	Level	Woodland
LIBOTweety19	5.0	Low	292	Low	Level	Woodland
LIBOTweety20	6.0	Low	291	Low	Level	Woodland
LIBOTweety22	5.0	Low	30	Low	Level	Woodland / Edge
LIBOTweety23	11.0	Low	318	Low	Level	Woodland
LIBOTweety24	4.0	Medium	299	Low	Level	Woodland
LIBOTweety26	13.0	Low	264	Low	Level	Woodland / Edge
LIBOTweety27	12.0	Low	33	Low	Level	Woodland
LIBOTweety28	10.0	Low	299	Low	Level	Woodland
LIBOTweety29	10.0	Medium	245	Low	Level	Woodland
LIBOTweety30	10.0	Low	223	Low	Level	Woodland / Edge
LIBOTweety31	10.0	Medium	40	Low	Level	Woodland
LIBOTweety32	8.0	Low	7	Low	Level	Woodland / Edge
LIBOTweety33	7.0	Medium	328	Low	Level	Woodland /Edge
LIBOTweety34	8.0	Low	303	Low	Level	Woodland
LIBOTweety35	11.0	Low	185	Low	Level	Woodland
LIBOTweety36	4.0	Low	305	Low	Level	Woodland / Edge
LIBOTweety37	4.0	Medium	272	Low	Level	Woodland
LIBOTweety38	6.0	Low	100	Low	Level	Woodland / Edge
LIBOTweety39	10.0	Low	298	Low	Level	Woodland
LIBOTweety40	5.0	Low	225	Low	Level	Woodland
LIBOTweety41	5.0	Low	164	Low	Level	Woodland / Edge

Table 4. Averages (± std dev) for habitat parameters at Lincoln Boyhood National Memorial, Indiana during the bird breeding seasons, 2007 and 2010. Within the scale in which habitat parameters are collected, 50-m plot, 5-m subplot, and 1.78-m sample plot, percentages of coverage may not necessarily sum to 100% as values are averaged over mid-point values of cover classes (i.e. class 1 = 0.5%, class 2 = 3.0%, class 3 = 15.0%, class 4 = 37.5%, class 5 = 62.5%, class 6 = 85.0%, and class 7 = 97.5%).

Habitat Parameter	2007		2011	
	Mean	std dev	Mean	std dev
50 meter plot coverage				
Woodland (%)	78.64	19.40	84.86	17.52
Lawn (%)	0.09	0.51	0.17	0.71
Roads / Trails (%)	1.37	2.67	1.27	1.36
Railroad Tracks (%)	0.51	2.57	0.51	2.57
Other (%)	0.10	0.51	2.43	14.37
5 meter subplot				
Canopy cover				
Hardwood (%)	92.66	7.00	84.12	6.42
Conifer (%)	0.41	2.07	0.42	1.51
Total cover (%)	92.73	7.05	84.66	5.39
Canopy Height				
Hardwood (m)	22.31	7.26	27.22	6.54
Conifer (m)	0.93	3.29	1.18	4.28
Basal Area				
Hardwood (m^2/ha)	19.43	6.67	27.07	13.50
Conifer (m^2/ha)	0.36	1.07	0.71	1.97
Horizontal vegetation profile at 15-m				
0.00 – 0.25 m (%)			89.79	19.12
0.00 – 0.50 m (%)	88.36	20.94		
0.25 – 0.50 m (%)			75.07	33.44
0.25 – 0.75 m (%)	70.09	31.98		
0.50 – 0.75 m (%)			53.29	37.46
0.50 – 1.00 m (%)	49.37	33.06		
0.75 – 1.00 m (%)			44.04	38.05
0.75 – 1.25 m (%)	27.33	30.61		
1.00 – 1.25 m (%)			39.57	37.41
1.00 – 1.50 m (%)	20.13	27.64		
1.25 – 1.50 m (%)			31.40	35.54
1.25 – 1.75 m (%)	17.67	26.08		
1.50 – 1.75 m (%)			28.67	36.28
1.50 – 2.00 m (%)	14.67	21.53		
1.75 – 2.00 m (%)			29.13	39.14
Vertical structure diversity (%)	24.22	13.32	36.05	16.02
1.78 meter sample plot coverage				
Deciduous litter (%)	38.66	20.08	70.57	17.96
Conifer litter (%)	0.09	0.51	0.06	0.16
Grass litter (%)	0.43	0.50	0.93	2.54
Bare soil (%)	6.57	7.50	2.67	7.38
Rock (%)	0.10	0.51	1.17	6.34
Woody debris (%)	5.80	12.30	19.97	13.68
Unvegetated (%)	87.14	4.78	84.36	13.82
Warm-season grass (%)	0.00	--	0.00	--
Cool-season grass (%)	0.63	0.89	3.07	8.96
Forb (%)	6.23	7.71	7.43	6.72

Table 4. Averages (± std dev) for habitat parameters at Lincoln Boyhood National Memorial, Indiana during the bird breeding seasons, 2007 and 2010. Within the scale in which habitat parameters are collected, 50-m plot, 5-m subplot, and 1.78-m sample plot, percentages of coverage may not necessarily sum to 100% as values are averaged over mid-point values of cover classes (i.e. class 1 = 0.5%, class 2 = 3.0%, class 3 = 15.0%, class 4 = 37.5%, class 5 = 62.5%, class 6 = 85.0%, and class 7 = 97.5%; continued).

Habitat Parameter	Mean	std dev	Mean	std dev
Moss and lichen (%)	0.06	0.16	1.34	3.47
Woody shrub and vine (%)	1.91	4.21	18.94	15.38
Tree seedling (%)	3.49	5.40	10.40	10.68
Total foliar (%)	29.40	12.51	39.59	17.47

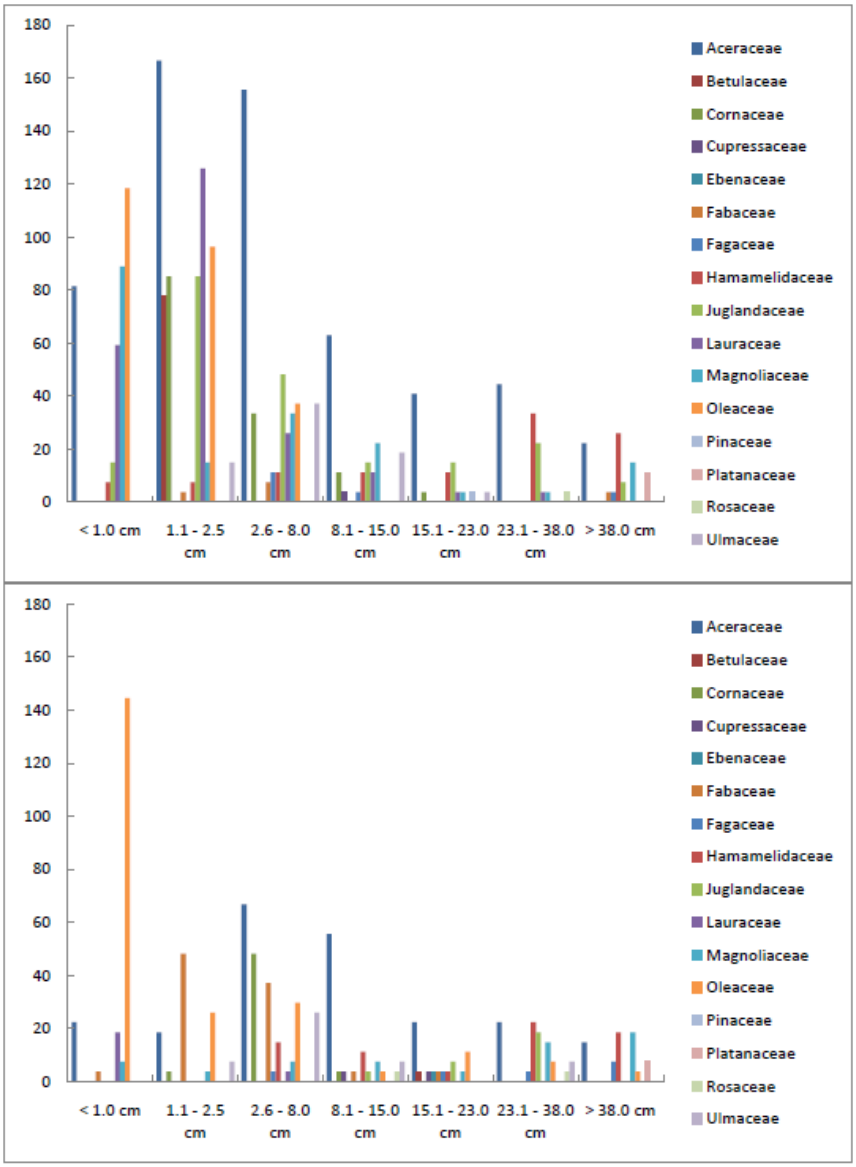

Figure 2. Stems per hectare by size class for tree families recorded on Lincoln Boyhood National Memorial, Indiana during breeding bird monitoring in 2007 (top) and 2011 (bottom).

Summary

Bird surveys and habitat assessment work were initiated at Lincoln Boyhood National Monument in 2007, to assist the park in assessing the ecological integrity of habitat on the Memorial through time. All 42 bird species recorded are permanent or summer residents to the area (Stokes and Stokes 1996). Current efforts to maintain and improve the woodland habitat at LIBO should provide the habitat necessary to meet the varied requirements of the 12 breeding species of continental importance observed.

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Appendix

Appendix 1. Plot I.D. and habitat type for each breeding bird survey plot at Lincoln Boyhood National Memorial, Indiana. Also given are x and y UTM coordinates for each plot. UTM Zone 16 North, Datum 1983 (Conus).

Plot I.D.	Habitat Type	X Coordinate (Easting)	Y Coordinate (Northing)
LIBOTweety1	Woodland / Edge	500432.278	4219695.381
LIBOTweety2	Woodland	500220.146	4219624.671
LIBOTweety3	Woodland	500432.278	4219553.960
LIBOTweety4	Woodland	500361.567	4219483.249
LIBOTweety5	Woodland	500432.278	4219412.539
LIBOTweety6	Woodland	500361.567	4219341.828
LIBOTweety7	Woodland / Edge	500290.856	4219271.117
LIBOTweety8	Woodland / Edge	500432.278	4219271.117
LIBOTweety9	Woodland	500361.567	4219200.407
LIBOTweety10	Woodland	500432.278	4219129.696
LIBOTweety13	Woodland / Edge	500290.856	4218988.275
LIBOTweety14	Woodland / Edge	500432.278	4218988.275
LIBOTweety16	Woodland	500361.567	4218917.564
LIBOTweety17	Woodland	500502.988	4218917.564
LIBOTweety19	Woodland	500290.856	4218846.853
LIBOTweety20	Woodland	500432.278	4218846.853
LIBOTweety22	Woodland / Edge	500220.146	4218776.143
LIBOTweety23	Woodland	500361.567	4218776.143
LIBOTweety24	Woodland	500502.988	4218776.143
LIBOTweety26	Woodland / Edge	500149.435	4218705.432
LIBOTweety27	Woodland	500290.856	4218705.432
LIBOTweety28	Woodland	500432.278	4218705.432
LIBOTweety29	Woodland	500078.724	4218634.721
LIBOTweety30	Woodland / Edge	500220.146	4218634.721
LIBOTweety31	Woodland	500502.988	4218634.721
LIBOTweety32	Woodland / Edge	500008.014	4218564.010
LIBOTweety33	Woodland /Edge	500149.435	4218564.010
LIBOTweety34	Woodland	500290.856	4218564.010
LIBOTweety35	Woodland	500432.278	4218564.010
LIBOTweety36	Woodland / Edge	499937.303	4218493.300
LIBOTweety37	Woodland	500078.724	4218493.300
LIBOTweety38	Woodland / Edge	500220.146	4218493.300
LIBOTweety39	Woodland	500502.988	4218493.300
LIBOTweety40	Woodland	500220.146	4218351.878
LIBOTweety41	Woodland / Edge	500502.988	4218351.878